

operation to a structure also provides evidence that the hypothesized operation actually occurs.

Although I have stressed the possibility of either decomposition proceeding in advance of the other, it also often happens that some progress in localization accompanies decomposition. For example, in the preceding sections I often characterized experimental inquiries into operations as inhibiting either the component part or operation. If investigators have also hypothetically linked that operation with a component part, then they can test this by excising the part to inhibit the operation. And likewise investigators can use evidence about operations to confirm that the parts into which they have decomposed the system are indeed working parts. When, therefore, it is possible to coordinate hypotheses about structural and functional decompositions in the course of research, it is advantageous to do so.

Testing Models of Mechanisms

So far in this section I have focused on the discovery of mechanisms. However, science involves not just the advancement of hypotheses but also testing whether they are true in a given situation. While logical empiricists had little to say about discovery, they did attempt to articulate criteria for evaluating proposed laws. Essentially, this involved making predictions from the laws and evaluating the truth of these predictions. The challenge was to articulate a logic that would relate the truth or falsity of a prediction to the confirmation or falsification of the law. This is not the occasion to review the problems and solutions that have been proposed; I simply note the genesis of the problems for confirmation or falsification. Confirmation is challenging because there are always alternative possible laws from which one might make the same prediction (the problem of underdetermination). Falsification is challenging because a false prediction might be due to an error either in the proposed law or in one of the auxiliary hypotheses that figured in deriving the prediction (the problem of credit assignment).

Modulo the difference that scientists typically make predictions from mechanisms by simulating their operation rather than by making logical deduction from laws, the challenge for testing hypotheses is much the same for mechanisms as for laws. A researcher tests hypothesized mechanisms by inferring how the mechanism or its components will behave under specified conditions and uses the results of actually subjecting the system in nature to these conditions to evaluate the proposed mechanism. In principle the same challenges confront tests of mechanisms as tests of laws – (a) different mechanisms might generate the same predictions (underdetermination); and